Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN IIUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	GEO SYNTHETIC DESIGN
COURSE CODE	:	BFG40403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY 2021 / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Briefly explain the function of geotextile filter that introduced below the rockfill layer of a typical box culvert.

(5 marks)

(b) Saturation of the backfill of a retaining wall is always accompanied by a substantial hydrostatic pressure on the back of the wall. As a geotechnical engineer, you are required to propose drainage provision for retaining walls by specifying the type of geosynthetics products. Give justification for it and provide a sketch of layout for your drainage system

(15 marks)

(c) A geotextile-wrapped trench drain is to be constructed to drain a soil mass The soil properties of the site were determined as:

Percentage passing 75 microns < 5%;
Permeability, k_s =2 x 10^{-4} m/s,
D_{10} = 0.14mm;
D_{15} = 0.18mm,
D_{60} 0.65mm;
D_{85} = 1.1 mm

Determine the appropriate hydraulic properties of the geotextile to function as a filter.

(5 marks)

Q2 (a) Briefly explain the function of geotextiles in reclamation works.

(5 marks)

(b) There are several types of geotextile material, including open-mesh, warp-knitted, and closed fabric or non-woven textiles. Different geotextile materials are specified for various characteristics, such as separation, filtration, drainage, reinforcement, sealing, and protection. Discuss the characteristics of geotextile material required for

(i) Separation
(ii) Reinforcement

(10 marks)

(c) A 5 m high and 10 m wide embankment is to be built on the soft ground with a basal geotextile layer. The embankment material has a total unit weight of 18 kN/m^3 and angle of friction 35°. Assume that the soil-geotextile interface friction angle is two thirds of the friction angle of the embankment material. Calculate :

(i) Geotextile strength
(ii) Geotextile modulus

that required to prevent the block sliding on the geotextile.

(10 marks)

Q3 (a) Reinforced earth is a construction material composed of soil fill strengthened by the inclusion of rods, bars, fibres or nets which interact with the soil by means of frictional resistance. The present practice is to use thin metal strips, geotextiles, and geogrids as reinforcing materials for the construction of reinforced earth retaining walls.

As a geotechnical engineer, you are required to propose a Mechanically Stabilized Earth (MSE) wall with geosynthetics products to retain soil with height of 6 m. The proposal should specify the type of geotextile products, its design concept in brief and provide a sketch of layout for your MSE wall

(15 marks)

(b) Design a 6 m Mechanical Stabilized Earth (MSE) wall using a geotextile as the reinforcement by consider one unit length of wall with one unit width of geotextile. The backfill is a compacted, coarse-grained soil with $\phi'_{cs} = 30°$, $\gamma_{sat} = 18kN/m^3$ and $k_{ac} = 0.3$. The surcharge load is found to be 20 kPa. The native soil is identified as clay with $\gamma_{sat} = 18kN/m^3$, $\phi'_{cs} = 32°$, $\phi'_{\upsilon} = 20°$, and undrained shear strength, $s_u - 60kPa$

The properties of geotextile is given as follow:

Ultimate wide width tensile strength – 58.5 kN/m;

- Soil-geotextile interface friction = 20°

Factor of safety for respective criteria is taken as:

- Factor of safety for installation damage, $FS_{ID} = 1.5$
- Factor of safety for creep, $FS_{CR} = 2.0$
- Factor of safety for chemical degradation, $FS_{CD} = 1.3$
- Factor of safety for biological degradation, $FS_{BD} = 1.3$
- Factor of safety for vertical spacing, $FS_{SP} = 1.3$
- Factor of safety against translation, $FS_T = 1.5$

Calculate:

(i) the allowable tensile strength of the geotextile
(ii) the vertical spacing at different wall heights
(iii) the length of reinforcement required at the base for translation.
(iv) the total length of reinforcement at each level for internal stability.

(10 marks)

Q4 (a) Briefly describe the mechanism of geotextile in reinforcing paved and unpaved roads.

(6 marks)

(b) Evaluate the importance of geogrid in reinforced soil.

(5 marks)

(c) Giroud and Noiray (1981) presented a design method for the geotextile-reinforced unpaved roads by combining the quasi-static analysis and the empirical formula. This

method evaluates the risk of failure of the foundation soil and of the geotextile. The geotextile is considered to function as only reinforcement. The failure of the granular layer is not considered. Discuss any **TWO (2)** of the assumptions in which the failure of the granular layer is not considered.

(4 marks)

(d) Determine the required thickness of the granular layer for the unpaved road in the presence of geotextile by using the design chart as included in this question book

It is given that.

Number of passes, $N = Ns = 500$
Single axle load, $P - Ps - 80$ kN
Tyre inflation pressure, $pc = 480$ kPa
Subgrade soil CBR = 1.0
Modulus of geotextile, $E = 100$ kN/m
Allowable rut depth, $r = 0.3$ m

(10 marks)

–END OF QUESTIONS–

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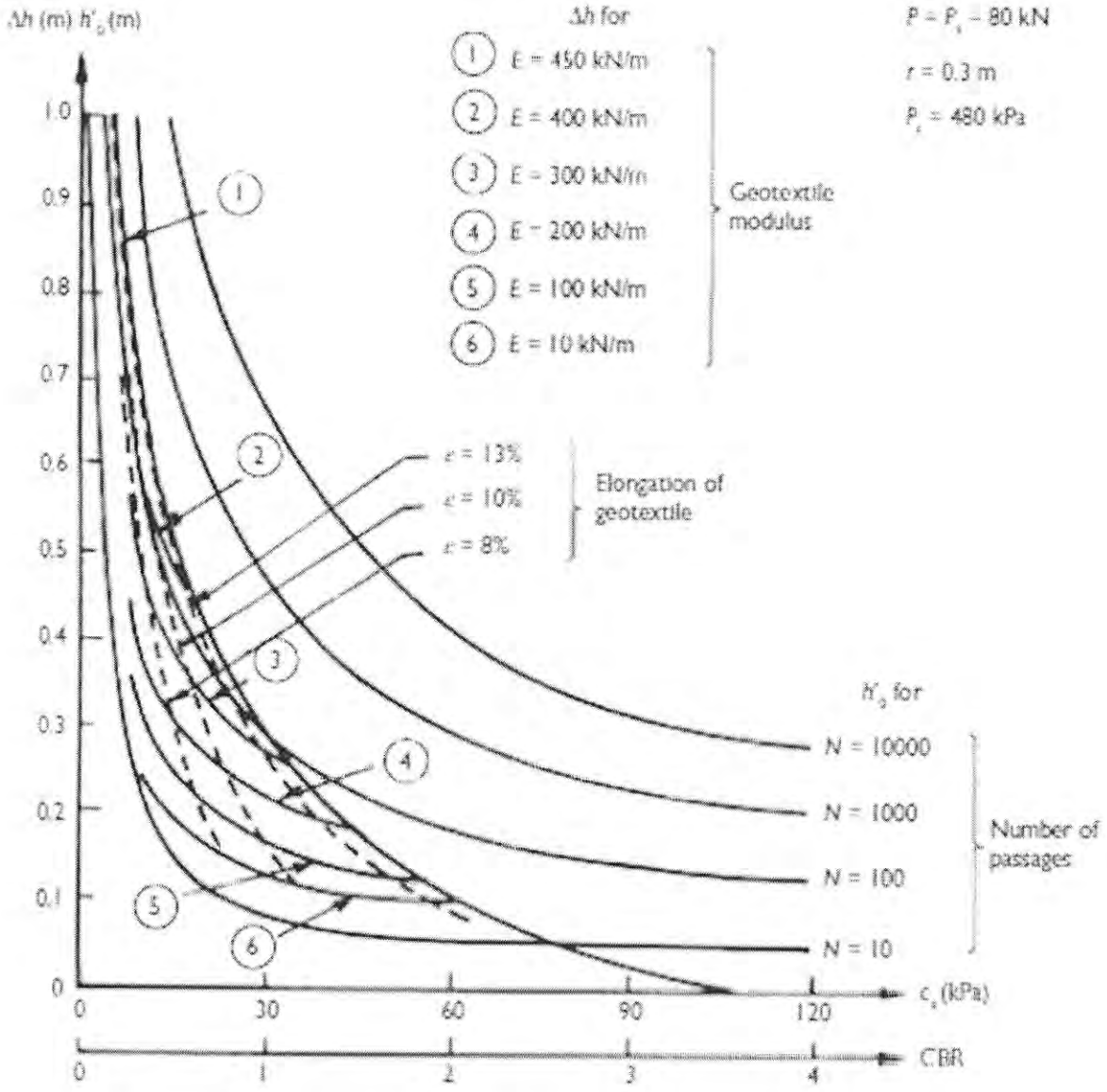

FIGURE Q4: Design chart for the geotextile-reinforced unpaved road related to on-highway truck with standard axle load of 80 kN (after Giroud and Noiray, 1981).